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Dependence of the Teacher's Overall Work Capacity on the Professional Expertise

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ABSTRACT

The topicality of the research is conditioned by the social and pedagogic, scientific and theoretical, and scientific and methodical aspects. With regard to this, the paper is aimed at revealing the dependence of the teacher's overall work capacity on the development of his/her professional expertise. The leading methods in studying this problem are theoretical and experimental ones that allow viewing the problem comprehensively. The paper presents the ways of evaluation of indices characterizing the condition of physiological, psychological and emotional components of the functional system that determine the level of overall work capacity of teachers and development of their professional expertise. The materials of the paper are of practical value for the heads of professional education organizations designing the pedagogues' professional development.

KEYWORDS
Development, professional expertise, work capacity, open system, quality

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Introduction

In the modern social and economic conditions, resolving the problem of teachers' professional development with their work capacity taken into account is caused by the necessity of teachers' retraining and skills improvement which is characterized by the state orienting towards the upgrade of vocational education, with special attention paid to the quality of vocational training. The new time puts forward new demands for training of specialists that are associated with change of their work capacity.

The particularities of teachers' social functions and professional activity condition the problem of their professional growth which is especially relevant. The essence of this development is seen in a radical restructuring of the entire system of the professional pedagogical education on the basis of ideas and

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methods of other sciences. Then the problem of developing abilities and skills of self-education and self-development in teachers gains a serious meaning requiring the appropriate conditions to be created too (Barmin, 2010).

The importance of the problem under consideration can be confirmed by at least four of its aspects:

- the social and pedagogical aspect of its relevance is determined by the need of the state of teachers featuring efficient work capacity; their successful professional activity depends on their abilities to act in social and economic situations in a responsible and professional manner;

- the scientific and theoretical aspect of its relevance is conditioned by IT penetration into the society requiring intensified vocational training, retraining and skills upgrading for teachers as well as by the necessity to integrate the currently dissociated various links of the pedagogical system of development of professional expertise in teachers while keeping their work capacity efficient;

- the scientific and methodological aspect of its relevance is marked by having to create a certain total of organizational and pedagogical conditions aimed at forming the required professional and personal qualities as well as to develop the training and methodological support of the mechanism of developing the professional expertise in teachers while keeping their work capacity efficient;

- the content-related and technological aspect of relevance of the problem is conditioned by transformation of the structure and content of postgraduate education and by identification of technology for mastering the content.

While describing the particularities of development of teachers' professional expertise in conditions of developing learner-centered education, the authors bore in mind the trends of development of the education systems in the world practice, their correlation with the opportunities for improvement of the educational system in Russia that are closely related to the modern stage problems of social and economic development of the state (Bulaeva & Petrov, 2012).

During retraining within the vocational education system, a teacher's organism is exposed to various loads: its mental and physical condition changes, the characteristic signs of fatigue of various kinds appear, work capacity decreases (Petrov et al., 2009) and so does the quality of perception of the content of the model as an open education system. Hence the development of the pedagogical system of vocational education has an increasingly "catching up" character in relation to the needs of the developing economy against the background of its qualitative change associated with a higher role of intangible assets and with professional expertise development turning into the principal competence.

In the world of functional systems, everything is built according to a uniform program and a common principle that is called the principle of organization of functional systems. Functional adaptive systems are a form of manifestation of activity in the living matter; their individual components interact providing results that bring about new quality for the entire organism (Anohin, 1973). Within the functional system theory, the teacher's overall work capacity depends on functioning of physiological, psychological and emotional components of the system.

Literature Review

The analysis of scientific and pedagogical literature has shown that currently conditions and ways for development the teachers' professional expertise while keeping their work capacity efficient are looked for actively.

In the conditions of the new social and economic relations, the labor marked created, growth of unemployment, the problem of training, retraining and skills upgrading of functionally literate and professionally mobile teachers who are able to quickly adapt to the changing social levels aggravated abruptly. A number of researchers say that the general deterioration in morals, depreciation of values, a high extent of individualization of work have affected the modern image of teachers as members of the society (Bondarevskaya, 2000; Loksha, 2002).

At present, the educational organizations are not prepared either to ensure the quality of training, retraining and skills upgrading for teachers which would be relevant to the development of society to the full extent or to ensure the security of their life activity. Keeping and developing a high mental and physical work capacity of the nation has to be addressed first of all to the pedagogical community (Erikson & Erikson, 1997). Learners are one of the social groups of the population who have a higher risk of developing the fatigue and change in work capacity caused by that. Adaptation of a teacher's organism under change of social conditions causes active mobilization and then a drop of the teacher's work capacity as a result of a prolonged or excessive load. As a rule, studies lead to fatigability and this may be taken into account for making the relevant change and designing the efficient work capacity.

When considering the character and professional content of pedagogics, it should be pointed out that the scientific support of developing the professional expertise in teachers is yet to come due to lack of elaboration of the social and pedagogical bases of managing their professional growth. The development of teachers' professional expertise becomes the subject of integrated research. However, with regard to this no qualimetric tools for assessing the professional capacity of teachers have been developed yet. Neither conceptual nor methodological approaches towards the professional development of teachers are determined, and only individual questions of raising the professional expertise of teachers are viewed within the aspect of transition to the new conditions. The study of the problem under consideration is rendered quite relevant by the society's objective need of teachers' professional expertise with their work capacity kept up, by an aggravated problem of lack of teachers possessing high social and moral, communicative qualities, and by the lack of scientifically grounded pedagogical system of development of teachers' professional expertise at vocational educational organizations.

The foundations of theory and practice of the professional and general cultural growth of teachers were studied by many scholars (Bespalko, 1998; Polat, 2007), yet it should be noted that no integral theory of teachers' professional expertise development has been worked out up to the present day. The need of it has become urgent due to the lack of a sensible methodological and methodical research apparatus for studying the teachers' professional expertise development as a complex phenomenon occurring in different components of their professional activity.

Numerous studies have confirmed the functional system theory. They have demonstrated that it is not only elementary physiological processes but also behavior of animals and humans on the whole that are structured similarly to functional systems (Noak, 1987).

The main criterion of evaluation of the functional condition of a teacher's organism is work capacity. Here, naturally, the researchers face the problem of working out such techniques as to be able to precisely diagnose the drop of work capacity in the main components of the functional system which is responsible for obtaining a useful result of the activity.

Essentially, the entire historical path that pedagogical theory and practice have traveled was the process of rise, formation, flourishing and replacement of the outdated systems by the new ones differing in functions, structure and certain elements and content incorporated into them (Smith, 2008). In scientific works, beginning with the ancient Greek and Roman philosophy and up to the present times, the problem of the man's regulating his activity has been the subject of debate of philosophers, physiologists, psychologists and teachers.

Turning to the philosophical thought, one can find that the capacity for regulating the mental processes and conditions of man was marked so early back as in the works of Aristotle (1984). The analysis of theoretical works has enabled the authors to suppose that Epicurus put the question about spontaneous, not determined by anything free choice of behavior, which further led to singling out the problem of human freedom as a standalone philosophical problem from this approach.

There are several possible causes of reduction of teachers' work capacity and they can be divided into two groups: the: psychological causes and physiological ones. Frequently they coexist and act jointly affecting the teachers' work capacity in an integrated way.

While considering the regulation processes as a mental process, the physiological aspects of the problem under study cannot but be paid attention to. The idea of behavior regulation as a special independent process is worded in works of I.M. Sechenov (1956). He believed regulation based on the human consciousness to need no special mental formation called will but to be exercised via the operation of certain nervous centers associated with conscious reflection. The cause of human actions is seen by I.M. Sechenov (1956) in sensual excitements, thoughts and moral feelings giving a certain meaning to the actions (Sechenov, 1956). Following I.M. Sechenov (1956), P.K. Anohin (1973) developed the functional system theory at the neuro-physiological level. Here regulation is viewed as the crucial internal capacity of biological systems for acting to ambient environment change proactively, forecasting the future actions and behavior as a whole on the basis of analyzing certain conditions and circumstances of life activity. Thus, the function of adaptation is the organism's main and determining one, and regulation is seen as the universal law of activity of the organism (Anohin, 1973).

The authors believe the above philosophical, psychological and pedagogical approaches to the notion "regulation" reflect various sides of one and the same phenomenon. The analysis of the definition performed by the authors has enabled them to isolate the key aspects mentioned by various authors while considering this notion. However, it should be borne in mind that there are

differences in determining the subject in philosophical, psychological and pedagogical research.

Having analyzed the concept and essence of regulation elaborated by the above scholars, the authors are of the opinion that regulation of teachers' study activity is one of the fundamental manifestations of the learner's individuality. The structure of regulation of study activity includes the following components: the objective of the study activity accepted by the subject, the model of significant conditions for the activity, the program of actions, control, assessment of the activity results and correction (Knowles, Holton & Swanson, 2005). The main component determining the particularities of the progress of activity regulation is the objective accepted by the subject (Lorin et al., 2001). In order to organize the activity according to the objective set, the latter has to be correlated to actual conditions where it is going to be attained (Bransford, Brown & Cocking, 2000; Darling-Hammond & Bransford, 2005).

The logics behind emergence of conscious regulation of one's activity in humans takes the central place in the context of subject-oriented approach to studying the personality. A personality as a subject of activity shows personal capacity for organization of activity and regulation (Domer, 1978). In the work of K.A. Abulhanova-Slavskaya (1980), the author says that "self-development of man is an essential determinant of the internal conditions of such development, structure of personality and principles of regulation" (Abulhanova-Slavskaya, 1980), and defines regulation as a universal principle of the scientific psychological analysis of human individuality. So, this brings the authors to the second theoretical approach without which it is difficult for a teacher to form the regulation of study activity – the subject one. Therefore, this is an exit to the problem of the rise of teachers' subject standpoint in development of their professional expertise.

A teacher as the subject of study activity influences all components of regulation. The teacher's subjective attitude to the educational activity is expressed in abilities and skills: "to independently set objectives of the study activity, to manage and control the process, to introduce change during the activity, to perform self-control and self-assessment and to make corrections of the methods of the activity" (Kulyutkin & Mushtavinskaya, 2002). Thus, the authors' point of view has been confirmed by theory: the level of subjectness in the study activity gives evidence about formation of regulation.

The activity of a teacher's personality is manifested in the ability to regulate one's behavior and activity (Froumin, 2015). During the activity, a need of a particular regulation mechanism arises. Conceptualization of such a mechanism acts as an important theoretical stage, for the capacity for activity and self-modification is the determining quality of personality. The authors single out the idea about interrelation of the regulated study activity and the internal thought actions in teachers that are nothing else but expression of self-reflection that is essential for the research.

Thus, projecting the previously worked out and mentioned above provisions on the problem of this research, the authors deem it necessary to make the essence of regulation more precise. They consider the conscious regulation as a consistently organized reflexive process associated with organization, maintaining and management of various kinds of human voluntary activity aimed at attaining the objectives set. Therefore, the methodological basis of the

study are ideas about the conscious regulation of teachers' activity as about a consistent process aimed at attaining the objectives.

The leading phenomenon of human activity, formation of a teacher's personality is the category "professional expertise" as the main quality of a person ensuring satisfaction by work and the result thereof. The professional expertise stands for a teacher's property to perform a complicated activity in a systematic, efficient and reliable way. Professional expertise is an extent of mastering the professional activity performed in the society in line with standards and objective requirements. For gaining the professional expertise, one needs abilities, wish and character, readiness for studies and improvement of one's proficiency.

Research Methods

An efficient vocational educational organization is one achieving high results in educating its graduates, ensuring the development of the capacity of its teachers and a decent quality of life of the educational community as well as making a positive contribution into the development of the society.

The technological constituent of the educational process includes the general educational technology and the total of special pedagogical technologies (Gibbons, 2002; Heathon, 1997). The general educational technology is viewed in a broad context and is defined as a system that includes: designing of measurable results of education, upbringing and development of learners; organizing the educational interaction, managing it and evaluating the quality of educational services; efficiently organizing an integral educational process promoting the reflexive mastering by the educational process subjects of social and individual experience; and the models of learning ensuring the result set by the state educational standard. Within the upgrade of the vocational education system, the modular and competence-based educational technology has been adopted as the principal one.

The modular and competence-based approach sees the teacher's ability to productively act in professional and life situations as the result of education, and the main results of vocational education to be the teacher's competences. The competence is determined first of all by some peculiar expectations of the employers and the society that are associated with the teacher's professional activity. Moreover, it is the extent of individual indices being up to the employer's and the society's expectations that is taken as the main parameter of expertise.

The experimental research under consideration includes two parts. In the first one, the result of a significant excess of indices after the learners studying the experimental group formed on the basis of the order (12) on modular author's programs and practicing of skills as compared to the same group before the experiment was obtained. The main experimental work was performed during 2014-2016 on the basis of Nizhny Novgorod Institute of Education Development" where the teachers of vocational educational organizations of Nizhny Novgorod region upgrade their skills. In the experimental research, the teachers who attended the regional innovation network educational project "A model of vocational educational organization as an open educational system" took part. The three stages of the research (those of 2014, 2015 and 2016) covered over 147 tested ones who underwent diagnostics 3-5 times.

The experimental research into the professional direction of teacher's personality according to motivation unit, professional standpoint unit, social and professional status unit and value reference points one was conducted at the beginning of experiment.

The teachers of ten experimental platforms of the innovation projects were diagnosed using the questionnaire of self-assessment of formation of the professionally important qualities of a teacher's personality, the questionnaire of the pedagogical technologies and forms of methodical work used in the educational process of vocational educational organizations, and the test for revealing the professional direction of personality of a professional system teacher which allows finding out the level of the teachers' professional expertise.

By the professionally important qualities (PIQ) of personality of a vocational educational organization teacher, the authors understand the qualities of the subject of vocational pedagogical activity influencing the efficiency of work capacity. Taking into account the significance of competence-based approach as the leading one in the system of vocational education and the requirements for the criteria and methods of assessing the professional qualification of teachers in accordance with the "Technique of assessment of pedagogical workers' qualification level" (13), the authors of this study have selected the following groups of professional pedagogical competences as PIQ for teachers working at vocational educational organizations: that in setting the objectives and tasks of pedagogical activity; that in the area of motivating the learners; the information one; the competence of working out the programs of pedagogical activity and pedagogical decision making; the one of organizing the study activity.

An innovation-oriented teacher views this profession as one of the most important ones; for such a teacher, the professional activity is a means for achieving self-respect and personal progress.

For innovation-oriented teachers, the following values act as priority ones: an active dynamic life, their profession, a high level of the professional expertise, self-improvement and development of personality during the process of learning something new, creativity, social responsibility, entrepreneurial spirit, readiness for change.

A higher level of the professional competence in pedagogical activity at project learning and evaluation of change of teachers' work capacity is determined by the target attitudes and the level of personality's aspirations to being recognized in the society. The readiness for a narrow range professional activity as a result of inclinations, understood motivations and value preferences is fulfilled in pedagogical activity that makes up the operational sphere of professional expertise in the model of an open educational system of continuous development of the professional expertise.

Results and Discussion

As a result of analyzing the diagnostics data, for each teacher, the personality focus on innovation was calculated that includes the information about direct motivation, professional standpoint, social and professional status, and the value reference points system. For a high level of personality focus on innovation, the teachers' considering innovative activity forms as a way for enhancing their professional expertise and self-development is characteristic.

Further data on formation of the teachers' professionally important qualities were obtained on the basis of questionnaire forms used in the educational process of vocational educational organizations and dealing with pedagogical technologies and forms of methodical work.

The results of the research into motives of learning and cognitive activity of teachers of experimental group at the beginning and at the end of the experiment when studying the technique of teaching were considered in line with the following: teachers' evaluation of the importance of studying the teaching techniques; teachers' self-reflection on the knowledge and abilities obtained in the author's course; teachers' evaluation of the extent of mastering the foundations of teaching; assessment of teachers' work at professionally oriented classes; teachers' evaluation of provisions related to IT penetration into the society and education, the use of ICT means.

The question of determining the levels of development of personal properties and qualities attracts the attention of both teachers and psychologists. In order to reveal the levels of development of the professional expertise, the authors used various questionnaire forms and techniques at different stages of the experimental work. Due to the necessity to identify the levels of development of teachers' professional expertise, the levels of expression for the professional expertise development criteria were worked out by the authors. The levels are characterized below:

Level 1 – the intuitive (low) one – implies the learners' having general ideas about the teacher's professional activity and joint interaction;

Level 2 – the standard (medium) one – the studying teachers realize the importance of the professional pedagogical retraining and skills upgrading for their professional activity;

Level 3 – the active (high) one – implies the formation of a system of professional pedagogical knowledge and a steady interest in supplementing it, so the studying teachers realize they have to master the professional pedagogical knowledge and abilities as conditions of a successful professional activity;

Level 4 – the creative (top), where the studying teachers have no difficulty joining the communication and take an active part in discussing the debatable questions that refer to professional pedagogical problems.

As a result of the diagnostic research, it has been found that 50% of studying teachers were characterized by the intuitive (low) level of development of the professional expertise; 32% - by the standard (medium) one, 14% - by the active (high) one and 4% - by the creative (top) level.

The validity of the professional expertise development criteria suggested was confirmed by the analysis of monographic characteristics of the studying teachers. The diagnostic studies have shown that it is the *motivational unit* that is formed the least in the studying teachers. The development of this unit was selected by the authors as a priority direction of their experimental work at the beginning of the experiment, so the following tasks were determined for the experimental research (at the beginning): to activate the interest for the professional pedagogical knowledge and abilities in the studying teachers; to supplement their knowledge about the importance of the professional pedagogical communication; to expand the studying teachers' ideas about the opportunities of

using the psychological and pedagogical knowledge in their professional activity; to get them acquainted with the main principles of debates leading; and to actualize the professionally and pedagogically important motives to be achieved and value attitudes in the professional activity.

Alongside with the analysis of tasks set at the beginning of the experiment, the diagnostics has also shown other change in the initial condition of the professional expertise in the experimental group of the studying teachers:

— the cognitive component – the attitude of the studying teachers to their profession and teacher's status in the modern society has changed;

— the communicative component - the studying teachers have familiarized with proving their viewpoints in a grounded manner;

— the reflexive component – it has manifested itself in the ability to evaluate oneself in communication situations.

The analysis of using the modern technologies in the educational process of professional educational organizations has shown that technologies ensuring formation in the studying teachers of qualities of an "innovative person" have to be mastered consistently (i.e. it is essential to go on to their usage as the main technology): the project learning, case technologies, cooperative learning, technologies of modular and block-modular learning. The analysis has also shown that as the most suitable methodical work forms the teachers mainly choose those traditionally used in the methodical support system. Meanwhile, attention should be paid to low demand for such form as creation / adaptation, testing out and implementing the methodical toolkits and didactic aids if the teachers show some professional deficits in fulfilling this ability.

Proceeding from the quantitative data obtained by them (Petrov et al., 2009), the authors performed the qualitative analysis of the results of the experiment. This has enabled them to have an idea about the extent of formation of various aspects of knowledge when evaluating the change in the teachers' overall work capacity level. In the second part of the experiment of checking the elaborated recommendations for the efficiency of work capacity, the authors have found the way the character of the load influences color sensitivity of the left and right eyes at changed loads of teachers' activity. The technique of measuring the critical flicker fusion frequency (CFFF) has been known for a long time but such studies were often conducted in one color – mainly white or red. The method of evaluating the condition of a learner based on measuring the critical flicker fusion frequency in two different colors has been used in this work for the first time (a patent).

Conducting the research (Letter of the Ministry of Education and Science of the Russian Federation N 03-339 «Methods of assessing the level of teachers` qualification", 2010; Order N 1152 of the Ministry of Education of Nizhny Novgorod region "On the organization of the regional innovative network educational project "Model of professional educational organization as an open educational system", 2014), the authors prove the following statements:

- any kind of load and all change occurring in the main components of the organism cause various change in the indices of sensitivity of the cone apparatus of the visual system when evaluating the teachers' overall work capacity level change;

- the condition of each component of the organism is reflected and prevails in the indices of sensitivity of certain cones of the visual analyzer;

- the indices of color sensitivity of the visual analyzer are measured in a succession to the red color, next to the green and blue colors;

- the measurements are first performed for the left eye and then for the right eye;

- the results of measurements are registered in a special table and drawn as a graph in the relevant coordinate axes: the X axis stands for the entire visible light range (from 380 nm to 780 nm) and the Y axis contains the CFFF parameters (in Hz).

The positive value of the difference between CFFF indices points to the right hemisphere domination (the triangle is located above the X axis) while the negative one – to the left hemisphere domination (the triangle lies below the X axis).

In order to prove the above statements, a special device for measuring the critical flicker fusion frequency (CFFF) of different colors – red, green and blue – for the left and the right eye individually.

Functional condition of the organism and work capacity are not constants. The teacher's mental and physiological condition undergoes certain change during the day, week, year. The level and dynamics of teachers' work capacity depend on a number of factors: on motives that make a teacher work at the classes; on conditions of study; on the type and nature of loads; on the mental and physical condition and prevailing emotions.

Colors are known to reflect the current functional condition of a teacher. Eyes are a priceless source of information about the functional condition of the organism. The functional condition "recorded" in the brain finds its reflection in the visual system. Diagnostics of condition of the eyes allows obtaining the most valuable information about the mind, feelings and physical condition of a teacher. Changed color perception is observed both as a result of mental and physical fatigue and in case of nervous and emotional stress. In other words, color sensitivity of eyes reflects the mental and physical condition of a teacher that determine the work capacity of the entire organism in the model of an open educational system.

The results of experimental research conducted "Dependencies of self-regulation of a teacher's organism" were discussed at the Academic board of Volga state engineering and pedagogical university in March 2009 and at the session of the Bureau of vocational education department of RAE in February 2010.

The method of evaluation of change of the overall teachers' work capacity level considered above was used in experimental studies and discussed at the meeting of the chair of "Vocational education and management of educational systems" of K. Minin Nizhny Novgorod state pedagogical university in January 2015. It allows:

- diagnosing the functional condition for the main components of the functional system of a teacher's organism;

- determining the condition of hemispheric color asymmetry and evaluating the change in the level of the overall learner's work capacity in response to the load set more precisely.

The material under study can be used in development and creation of new methods of in-process monitoring and evaluation of the overall work capacity and individual components of the functional system of a teacher's organism, as well as in working out of techniques and devices for enhancing the teachers' capacities and restoring the work capacity using regulation and self-reflection during studying.

Conclusion

The information sources available to the authors contain no methods of evaluation of indices characterizing the condition of physiological, psychological and emotional components of the functional system that determine the level of the overall work capacity of a pedagogue before and after the study load.

Based on the material of this paper and the results of the pedagogical experiment, the following aspects should be noted:

— professional deficits of teachers in the areas of information competence and pedagogical activity programs development competence have been revealed;

— lack of consistency in application of the modern innovation technologies and methods of teaching has been found, as well as the fact that the most relevant technologies of the modern vocational education in conditions of innovation development – project learning, modular and block-modular learning, cooperative learning (learning in cooperation) and case technologies – are used in the educational process insufficiently;

— with the optimum mastery of learning motivation methods (via the study material, interesting tasks, support of the learners' creativity), the teachers show an insufficient level of mastery of motivation methods which involve various sides of the emotional and need-related sphere of the teacher's personality;

— it has been stated that among teachers the most popular forms of methodical work are teaching seminars, workshops, open lessons (extracurricular activities);

— it has been found that the teachers are not prepared for creation of their own methodical and didactic materials, program developments (which is extremely necessary in conditions of new FSES being introduced) and they are mostly oriented to using someone else's ready training toolkits;

— during the experiment, the authors have elaborated and implemented the levels of a teacher's professional expertise: intuitive, standard, active and creative ones;

— for identifying the level of a teacher's professional expertise the methodological support developed by the authors was used;

— it has been shown during the research that the conceptual grounds for efficiently modeling the professional expertise of a teacher of vocational educational organization can be provided on condition that the above principles are adhered to.

The results of experimental studies allow:

- diagnosing the functional condition of the main components of the functional system of a teacher's organism during the professional skills upgrading;

- evaluating more precisely the change of the level of the teacher's overall work capacity in relation to the expected load during the professional skills upgrading; and

- when training various skills, a complete restructuring of interaction between systems of the organism takes place and such a form of these is created that is the most favorable for obtaining a high quality result in controlling the work capacity of a teacher in the model of an open educational system.

Disclosure statement

No potential conflict of interest was reported by the authors.

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